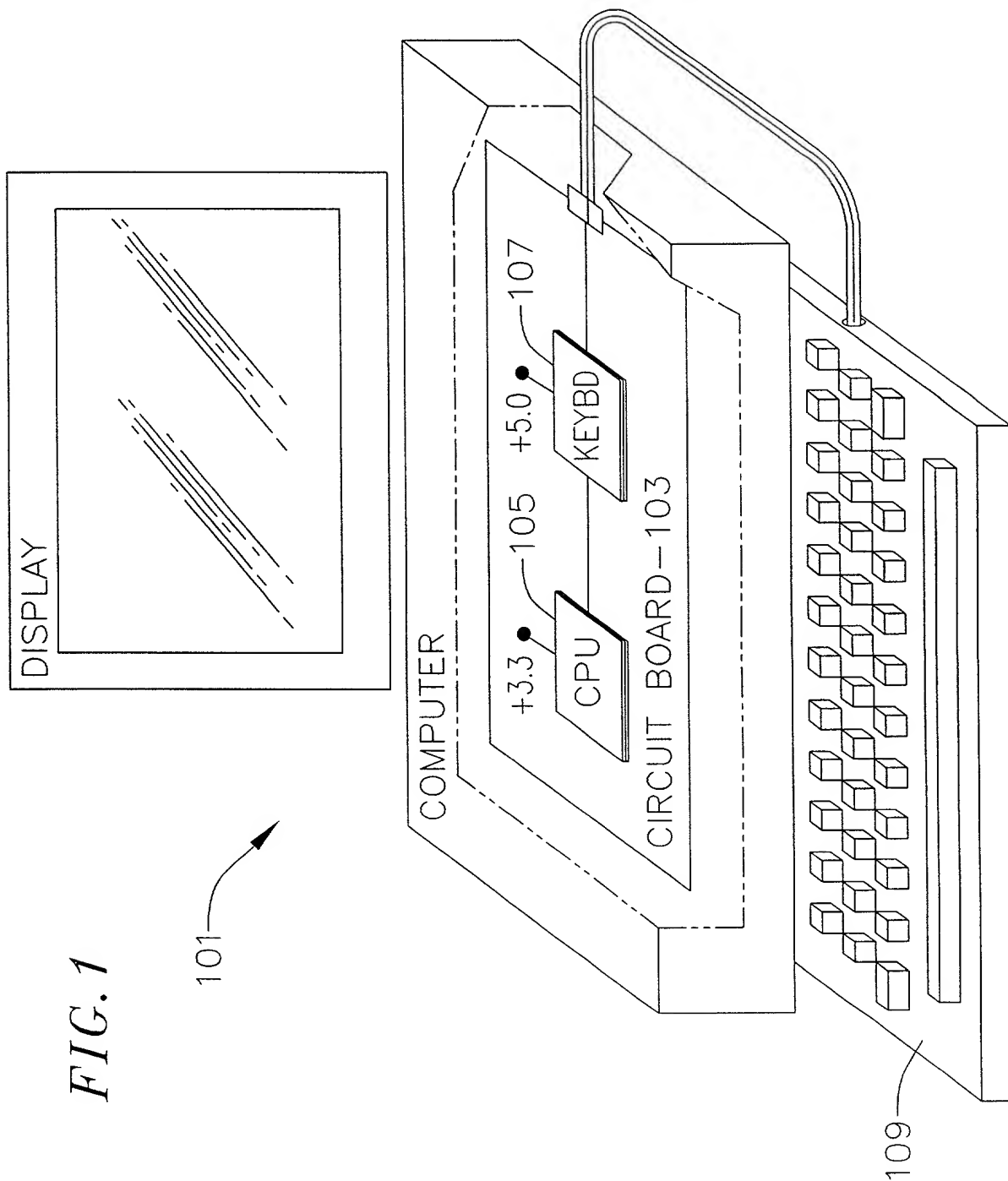Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS

Sheet 1 of 23
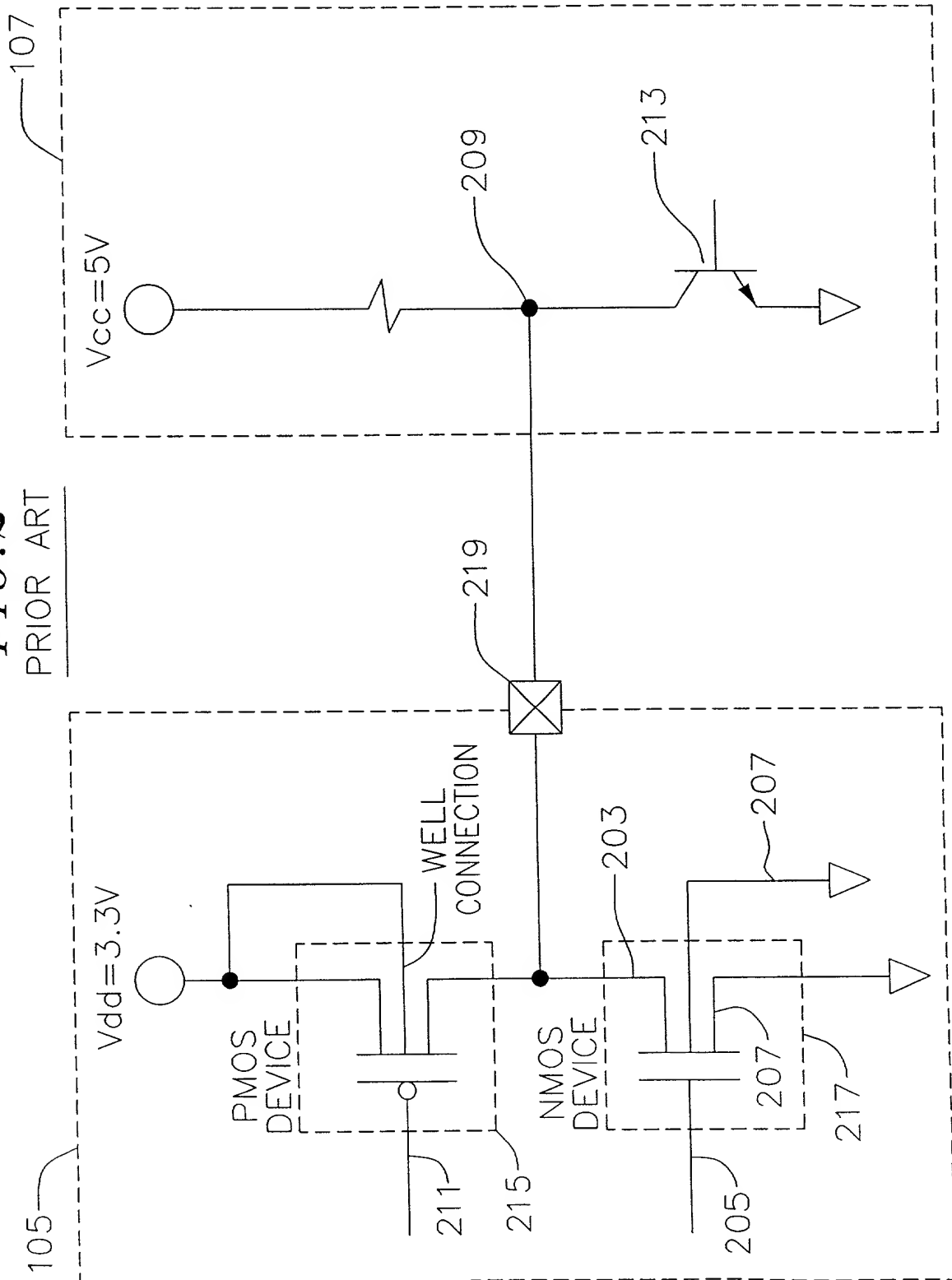
FIG. 1

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 2 of 23

FIG.2
PRIOR ART

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 3 of 23

FIG.3

V_{DDO}

301 PMOS DEVICE

303 PMOS DEVICE

207

309 INPUT OUTPUT PAD

305 NMOS DEVICE

307 NMOS DEVICE

Application No. 10/043,763
Inventor(s): Janardhanan S. Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
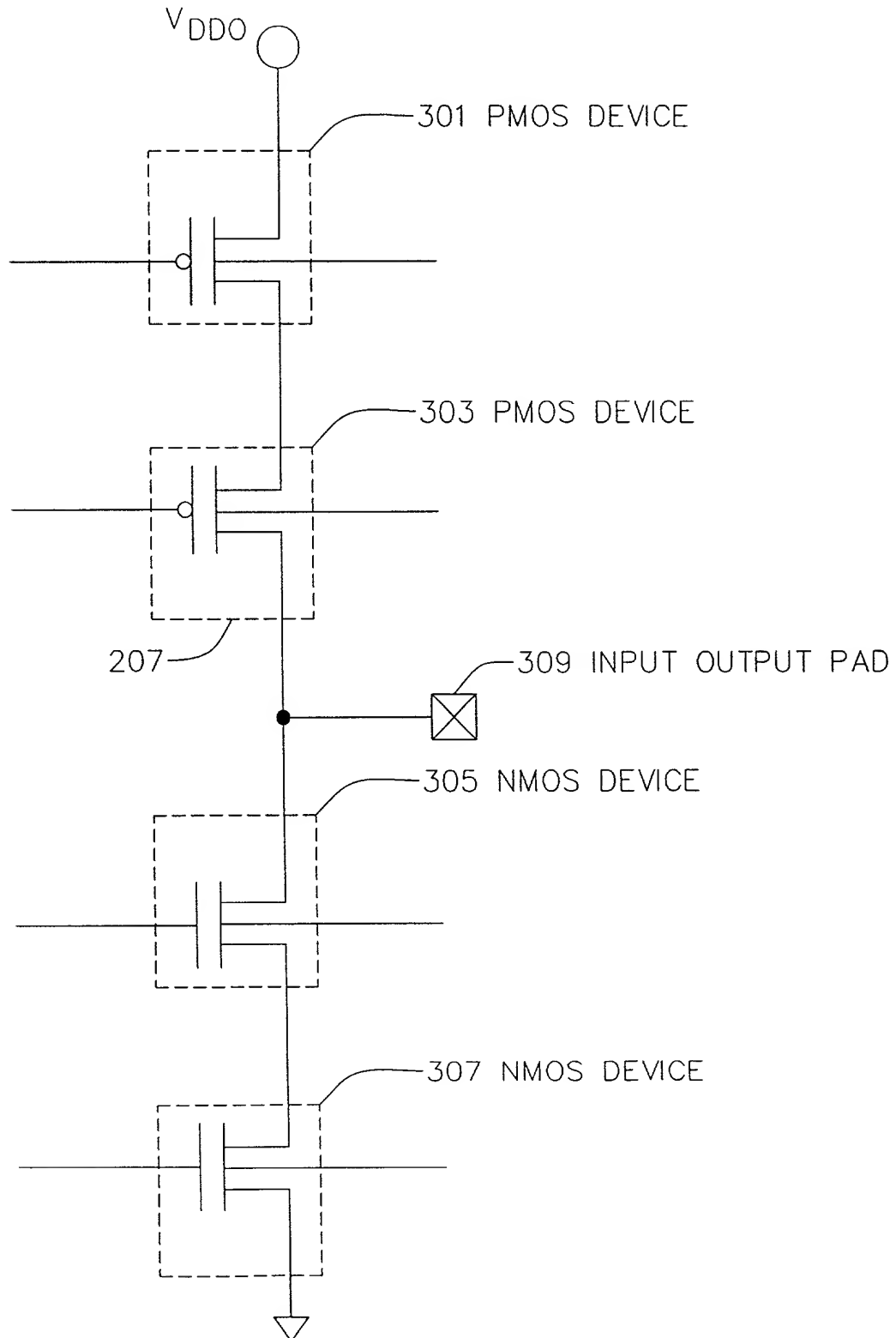ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 4 of 23

FIG.4

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
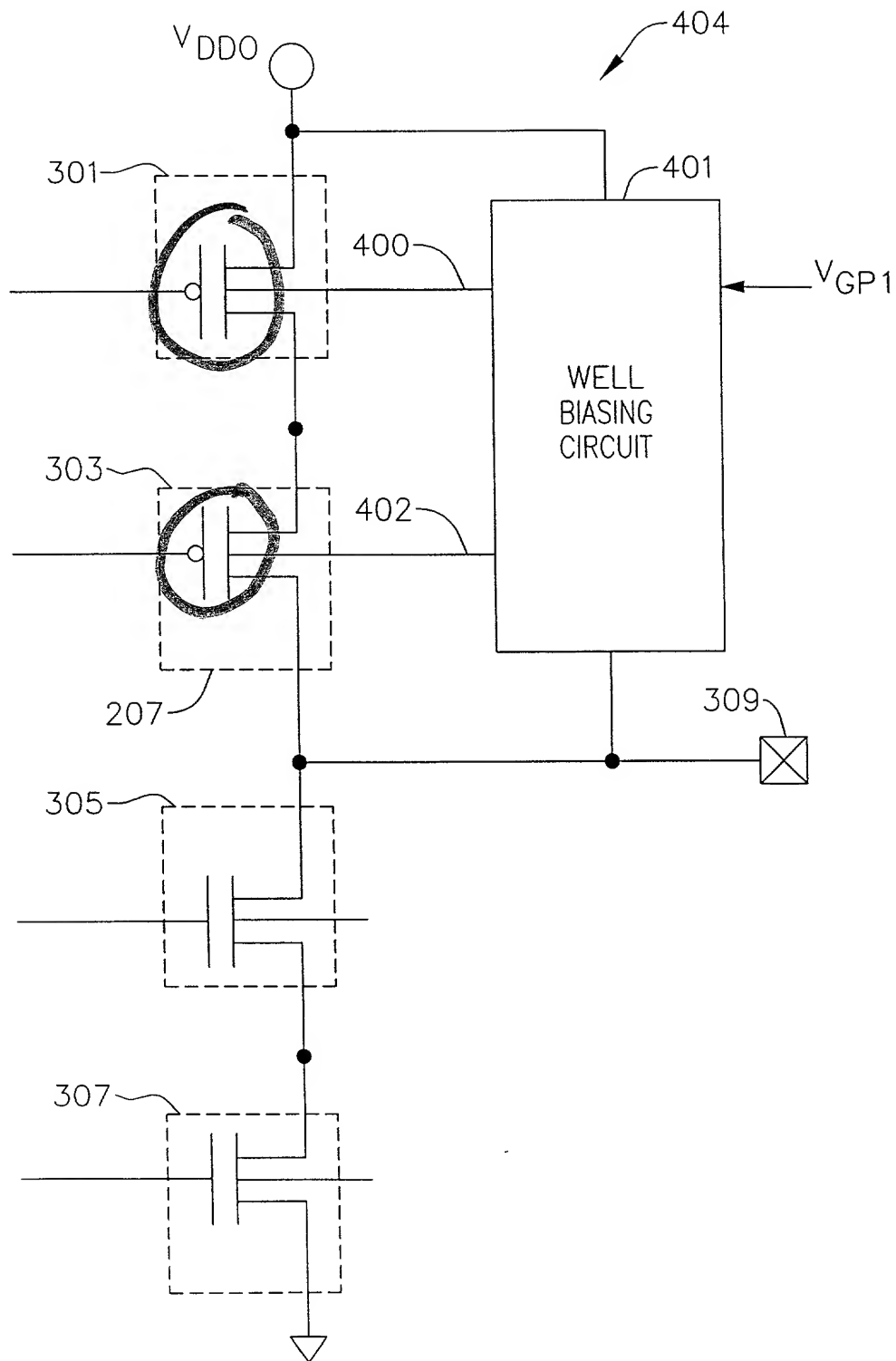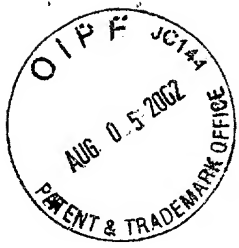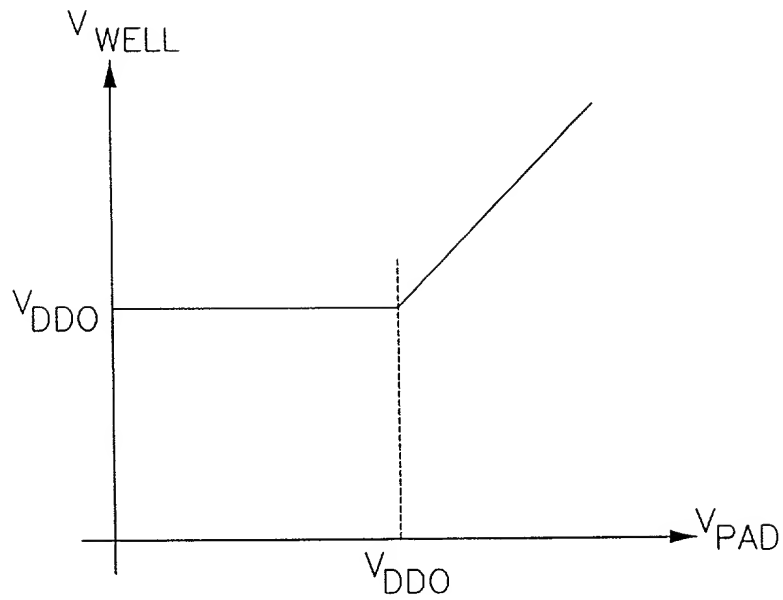ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 5 of 23

FIG.5

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS

Sheet 6 of 23

FIG.6

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 7 of 23

FIG.7

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
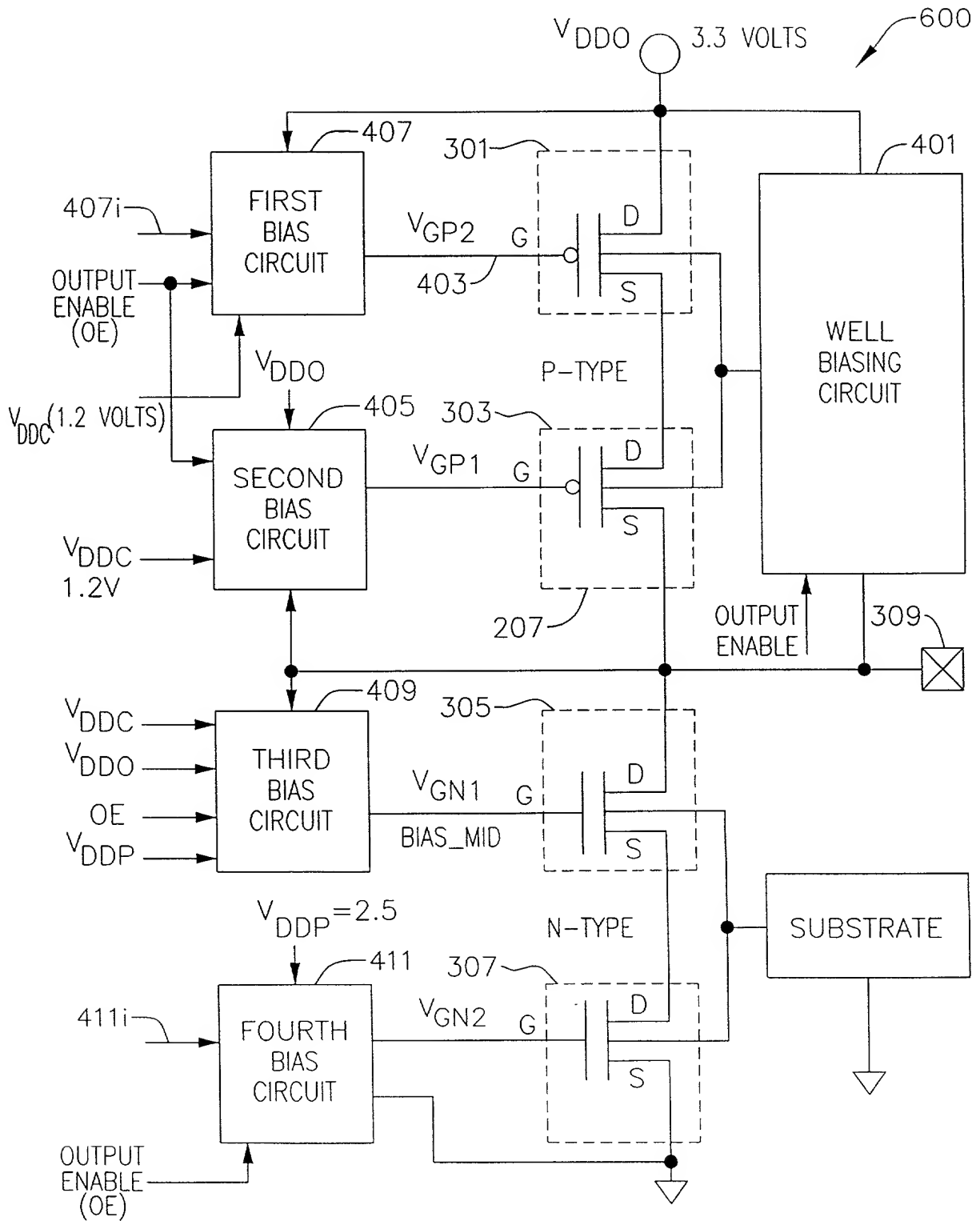ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 8 of 23

FIG.8

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 9 of 23

FIG.9A

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
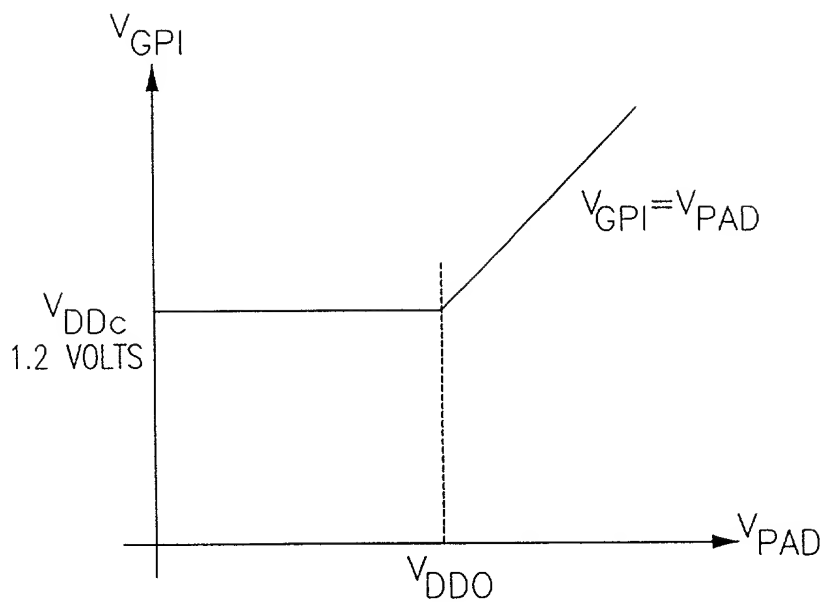VARIATIONS

Sheet 10 of 23

FIG.9B

(ALTERNATELY V_{DDC} OR V_{DDP})

Application No. 10/043,763
Inventor(s): Janardhanan S. Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
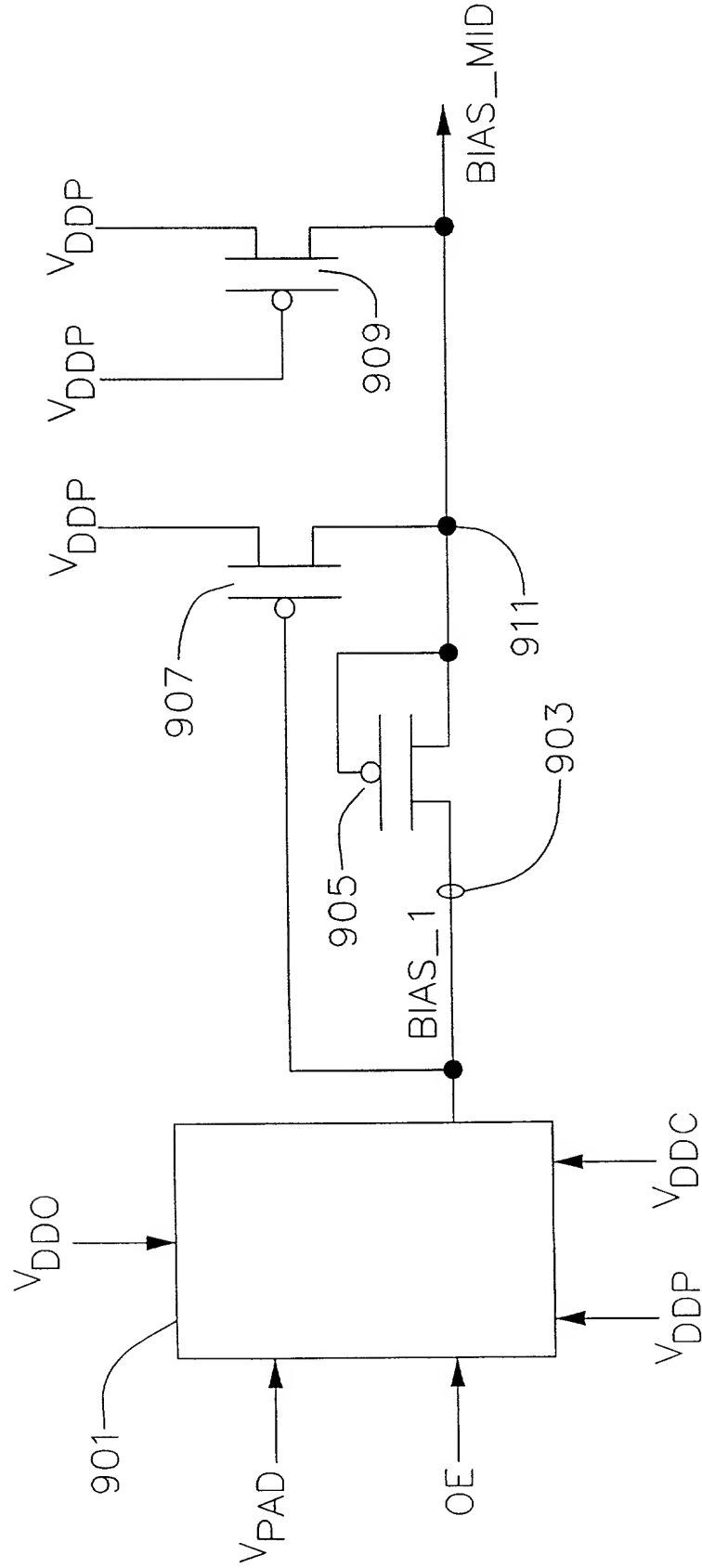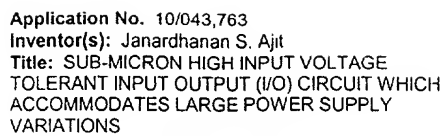VARIATIONS
Sheet 11 of 23

FIG.10

FIG. 11A

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
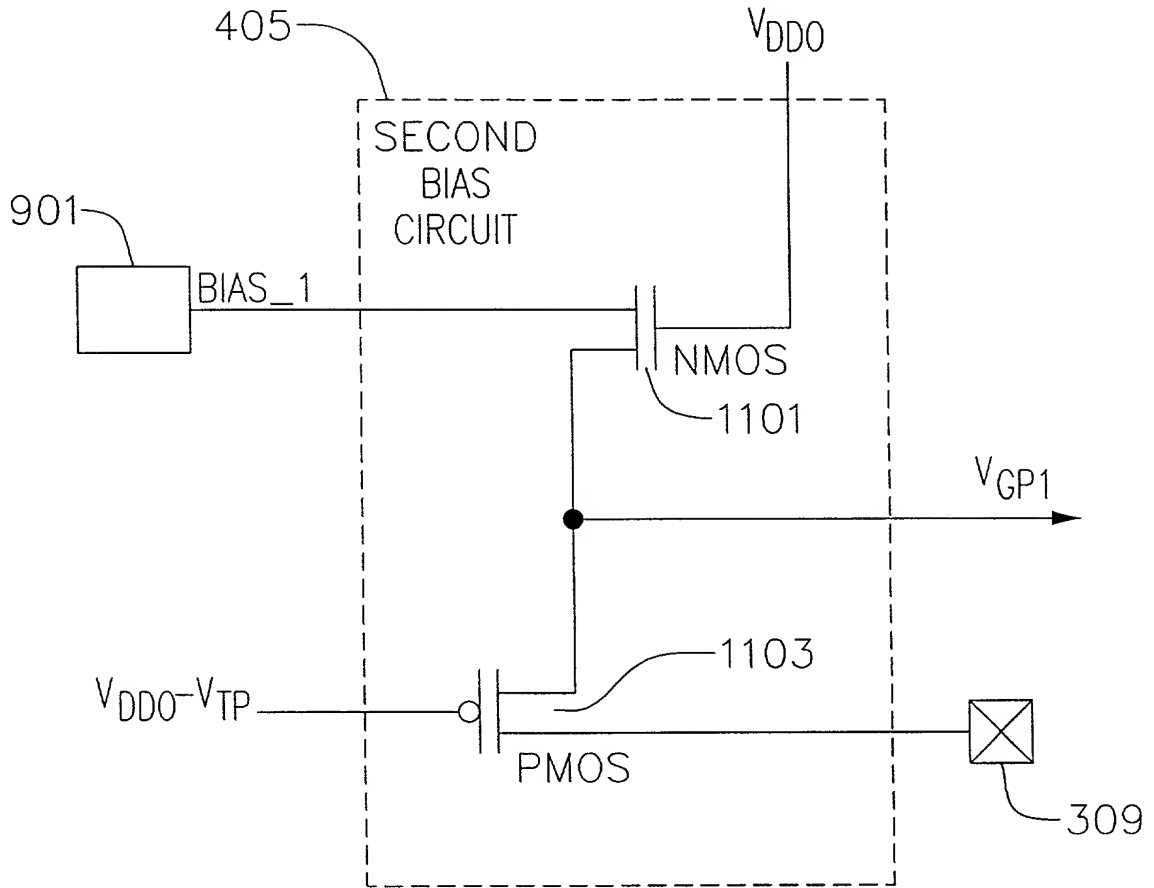ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 13 of 23

FIG. 11B

V_{DDO}

STRONGER DEVICE

$V_{DDO} - V_{TP}$

WEAKER DEVICE

V_{DDP}

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
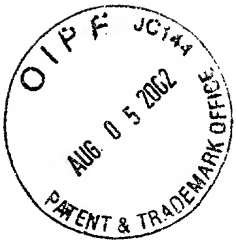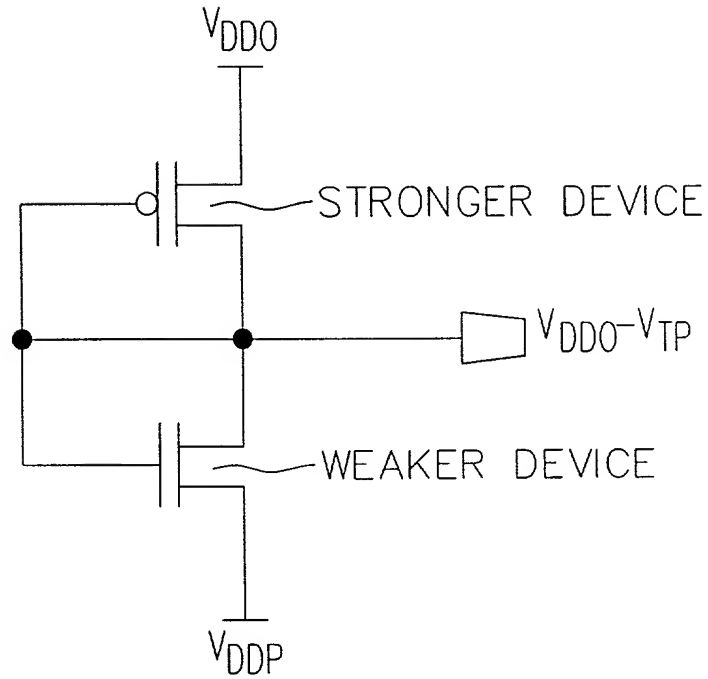ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 14 of 23

FIG.11C

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
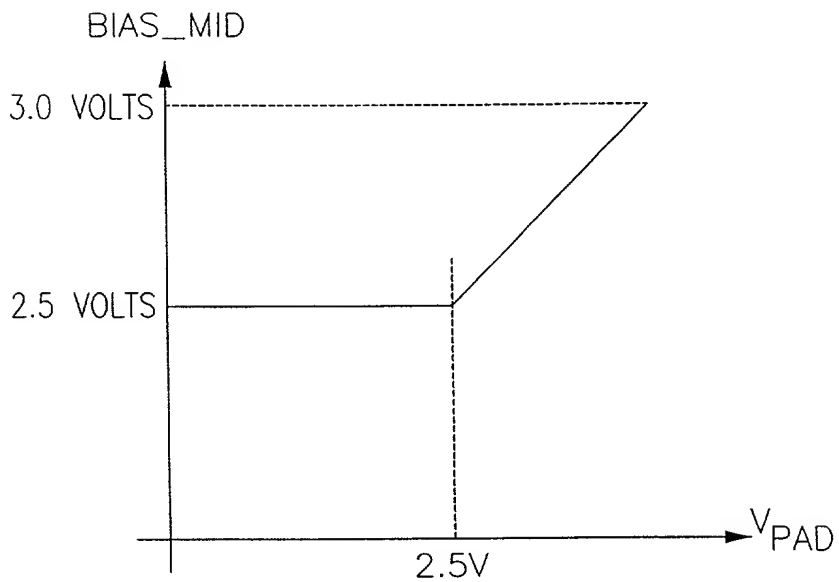ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 15 of 23

FIG.11D

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 16 of 23

FIG. 12A

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
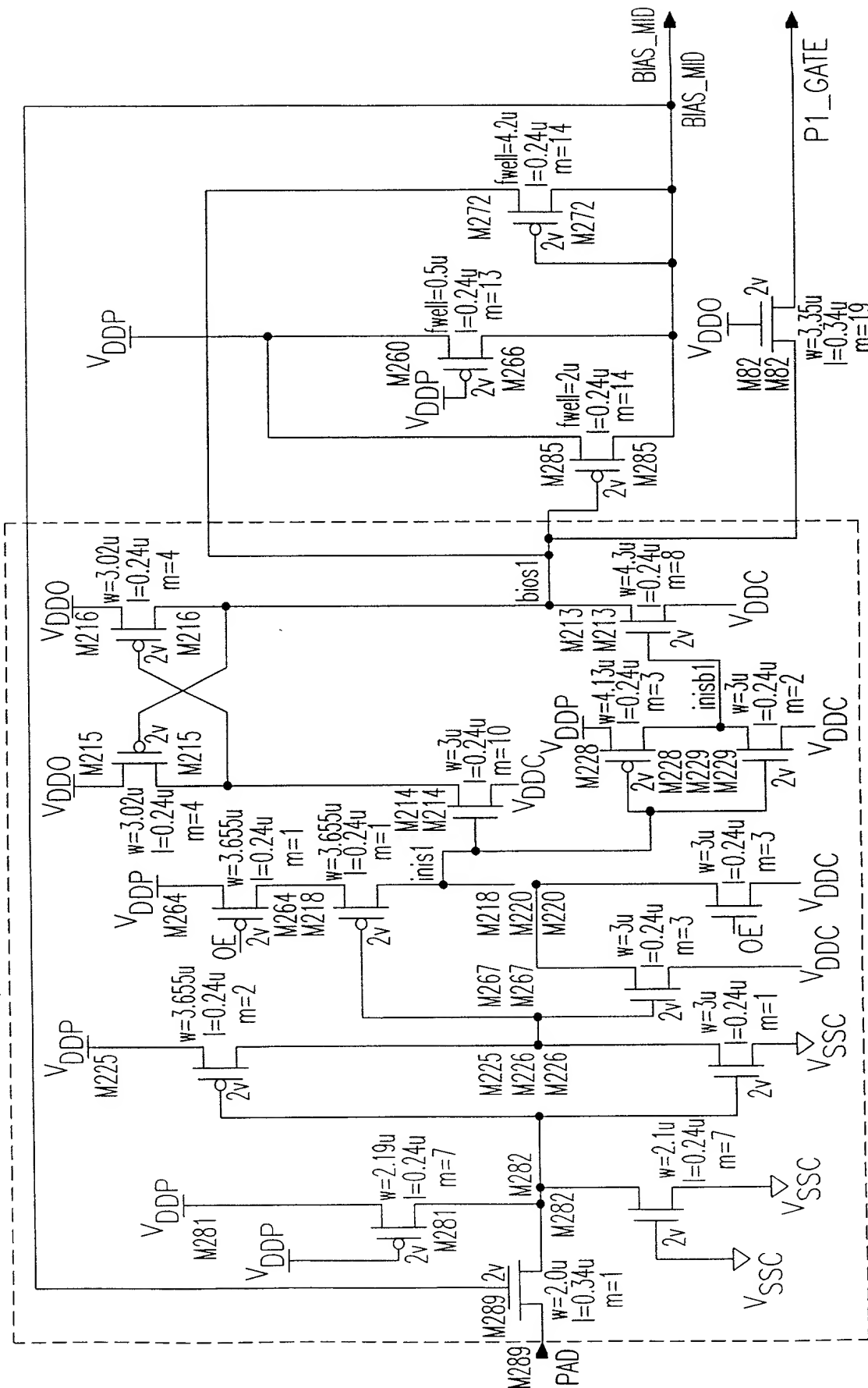VARIATIONS
Sheet 17 of 23

FIG.12B

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 18 of 23

FIG.13

P_GATE

WELL

1301

$V_{DDO} - V_{TP}$

1001

$V_{DDO} - V_{TP}$

PAD

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
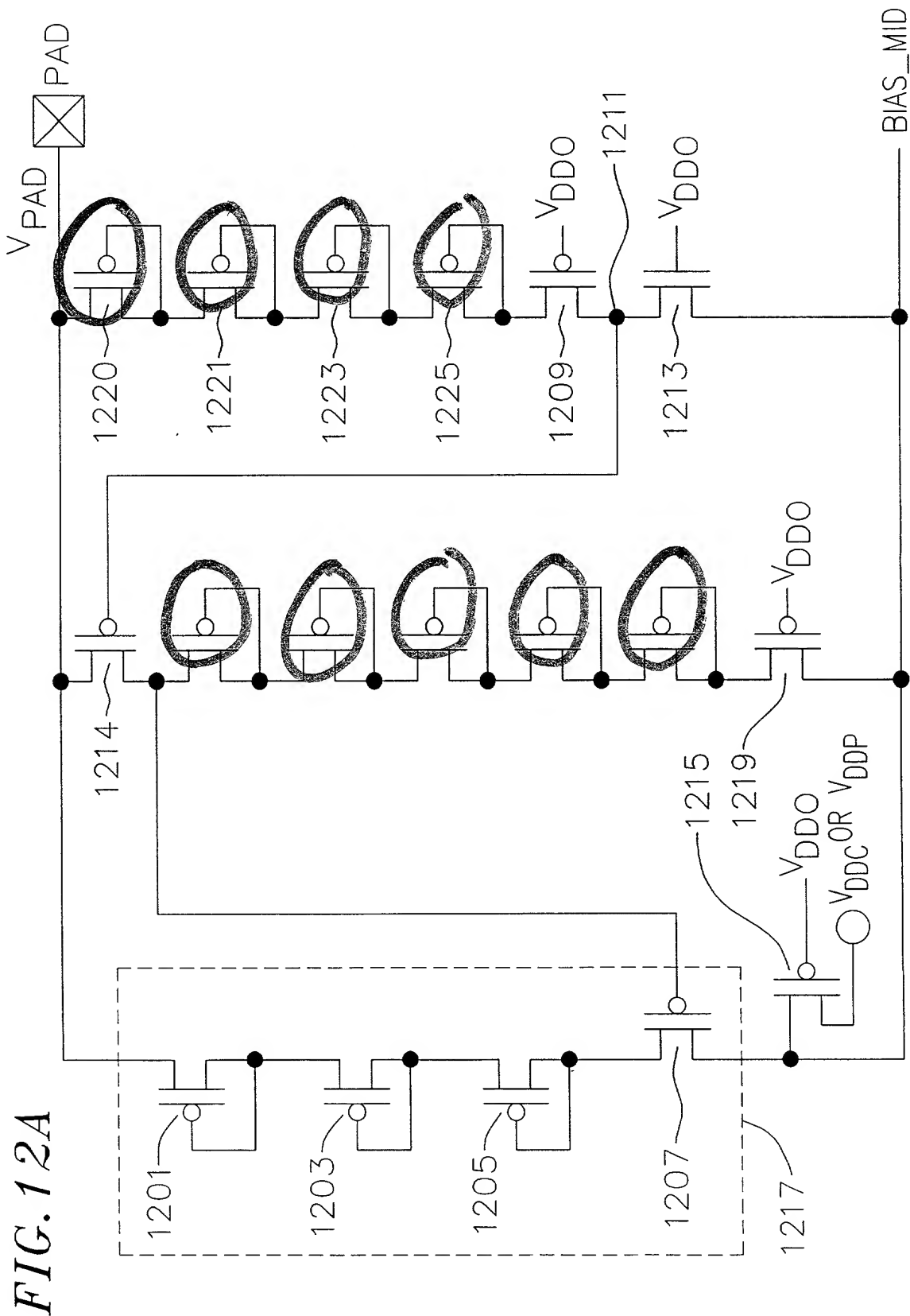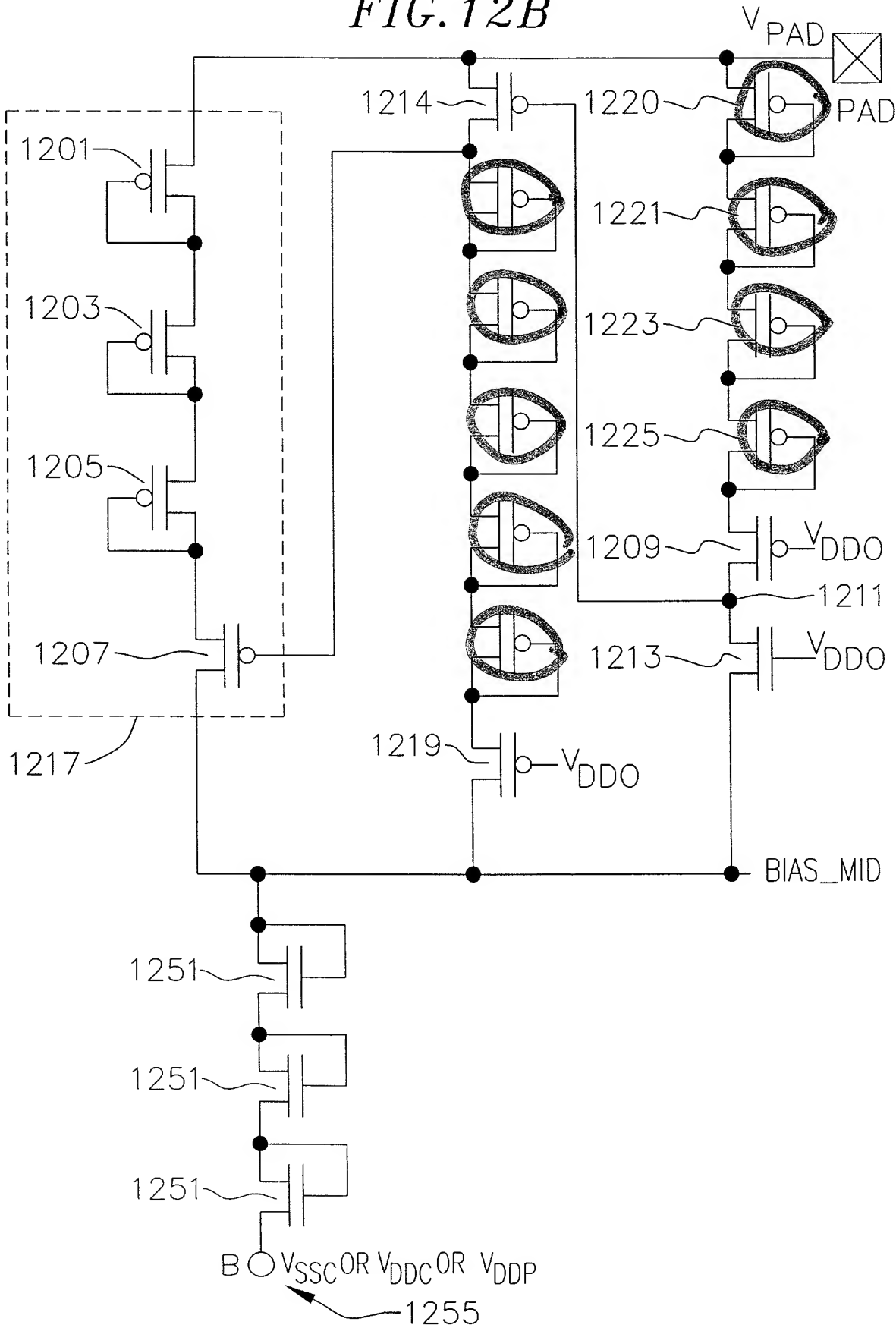ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 19 of 23

FIG.14

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
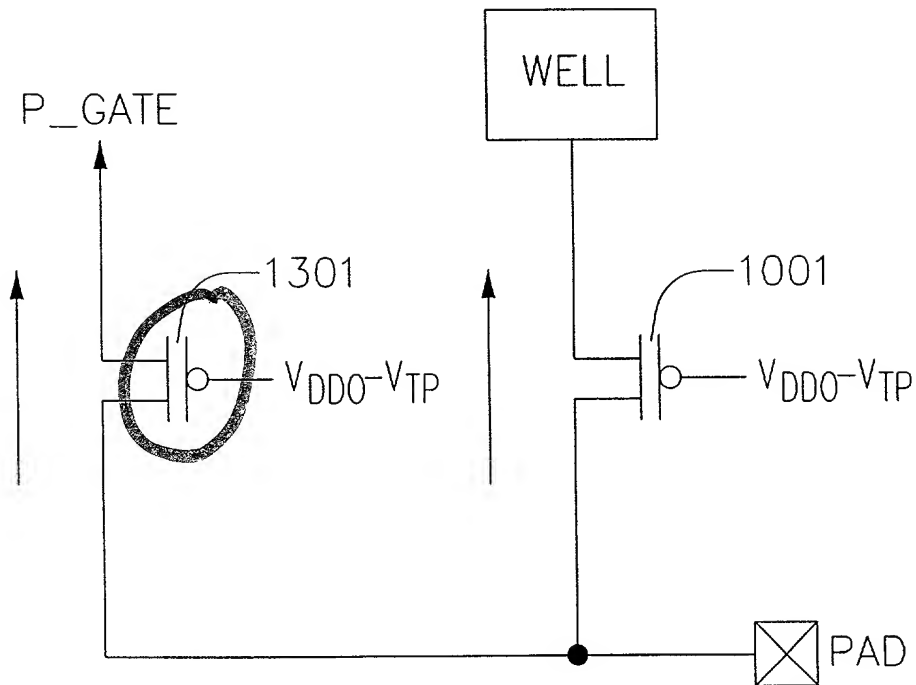ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 20 of 23

FIG.15

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 21 of 23

FIG. 16

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 22 of 23

FIG.17

Application No. 10/043,763
Inventor(s): Janardhanan S Ajit
Title: SUB-MICRON HIGH INPUT VOLTAGE
TOLERANT INPUT OUTPUT (I/O) CIRCUIT WHICH
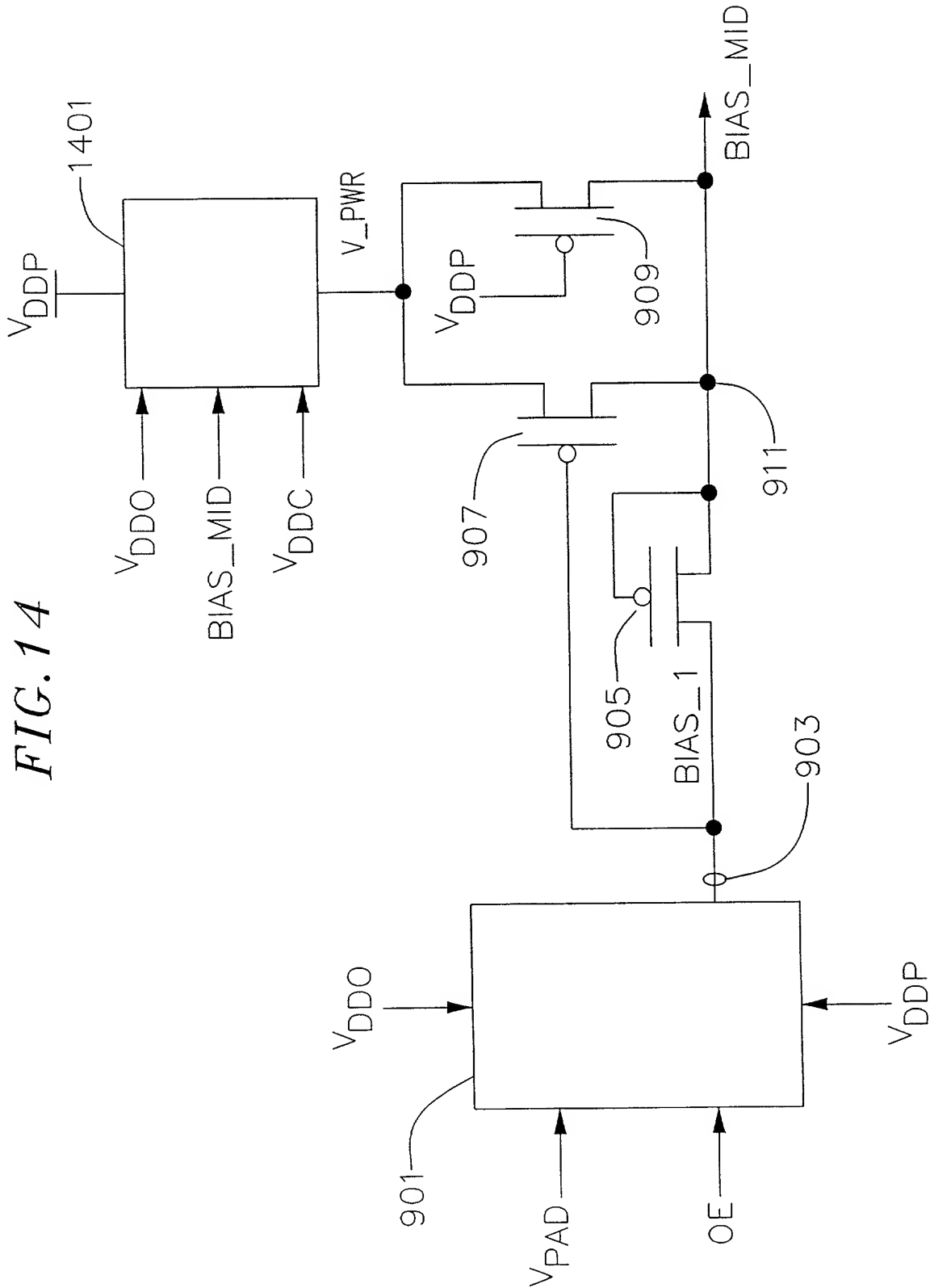ACCOMMODATES LARGE POWER SUPPLY
VARIATIONS
Sheet 23 of 23

FIG.18